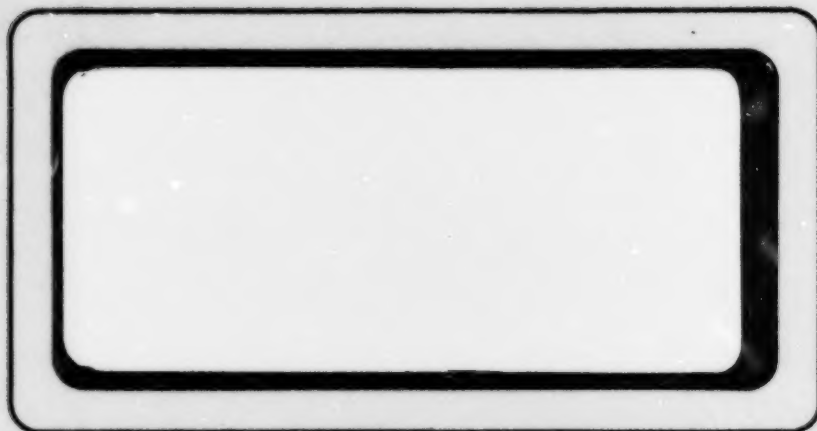




Province of
British Columbia

Ministry of
Environment

A FIELD MANUAL AND GUIDE TO THE
COLLECTING AND PRESERVING OF
B.C. AQUATIC PLANTS

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There are about 200 species of aquatic plants found in British Columbia. While the collection and preservation is basically the same for most of them, details vary sufficiently from species to species to make a detailed discussion necessary if prime specimens are to be acquired. The major problem with aquatic plant collection is that many collectors do not recognize the plants they are collecting hence do not give each specimen the individual treatment often required. This is an attempt to organize aquatic plants into a few large groups which share common collection and preservation techniques. Latin names will be used freely to assist those who can identify the plants and descriptive phrases for those who can not.

Most submerged plants do not have structural supporting tissue as they rely on the water for support (this is why they are virtually useless for compost). Since the submerged portions of aquatic plants do not have waxy or water repellant cuticles, having no need to protect themselves against dessication, do not leave collected aquatics lying about in the sun even briefly. They will dry out and wither very quickly, becoming useless as specimens. Keep them in a bucket or bag of water at all times until you are ready to press them. If you do not have a tray and must do your mounting in a lake, do it in the lake from which you collected the plants. Do not carry them on the the next lake and risk spreading aquatic weeds to new sites.

The following key splits the plants into three major groups which have many collection and preservation techniques in common.

1. The plants are very small and freely floating on or under the water surface. They may be stranded on wet mud by declining water levels. Many of them will fit into a 20 ml vial. This group includes the duckweeds and similar plants.

- GROUP 'A'

1. The plants are generally larger and usually rooted in the bottom with leafy stems and may be submerged, floating or emergent. A few species are small enough to fit in a 20 ml vial.

2. The plants are emergent marginals or if submerged or floating they do not collapse or clump together when removed from the water. These plants are all stiff and hold their shape.

- GROUP 'B'

2. The plants are submerged and usually have fine or delicate leaves and stems and tend to collapse into a clump or mat when removed from the water.

- GROUP 'C'

Each of these groups will be dealt with separately on the following pages.

GROUP A

These are all small floating plants (many specimens will fit in a single 20 ml. vial). They may be found growing on damp muddy banks, shaded from the direct sun, when left stranded by declining water levels. Since they are small and free-floating they congregate in sheltered areas and are rare in open water sites. In large lakes they will be found in down-wind log-jam areas and among dense beds of other emergent aquatic plants along the shore. They are more generally found in ponds, ditches, sloughs, embayments and other protected waters rich in nutrients but with little if any fetch.

The duckweed Lemna trisulca and usually the bladderworts Utricularia minor and U. gibba are submerged; the others all float on the surface. The floating plants include duckweeds - Lemna gibba, L. minor, Wolffia punctata and Spirodela polyrhiza; two aquatic liverworts - Riccia fluitans and Ricciocarpus natans; an aquatic fern - Azolla filiculoides; and occasionally as an aquarium escape another aquatic fern Salvinia rotundifolia. Except for Wolffia and Utricularia these plants are illustrated on the Group 'A' figure. The Utricularia spp. are represented by U. intermedia in the Group 'C' figures. Wolffia punctata is so small and featureless that it is not illustrated.

DESCRIPTIONS OF THE GROUP 'A' PLANTS

Wolffia punctata is very small and almost featureless even at 10x magnification. Its common name is watermeal and it often looks like pollen grains floating on the surface. It is not very common, or at least rarely recognized and collected in B.C. but is usually found mixed with other duckweeds. Lemna gibba and Lemna minor are very similar to each other, green, and have one or a few roots on the bottom of the frond. They will rarely be distinguishable in the field. Spirodela polyrhiza is green on top, red beneath and has many roots on the bottom of each frond. Lemna trisulca is unique and should not be confused with anything else. Azolla is

very rare, known only from the Shuswap area, and looks like overlapping scales. Salvinia is not known to over-winter in B.C. when introduced. It is a pale green and very hairy. It is extremely unlikely that either of these last two species will be found. Ricciocarpus is dark green on top and nearly black beneath with a very dense mat of rhizoids. It is fairly widespread but prefers ditches with overhanging banks and vegetation which provide shade. Riccia is common in the Okanagan in sheltered, warm water and is a pale light green.

COLLECTION METHODS

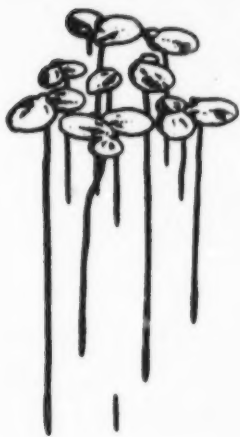
These small plants do not make satisfactory pressed and dried specimens and are best preserved in a vial. It is recommended that these vials be taken into the field and the plants collected directly into the vials with a little water. Each vial should then receive a label in pencil on waterproof paper giving the date, the name of the site (reach, lake, sample point) and the name of the collector. Later in the day the water should be replaced with a preserving fluid composed of 5% formalin, 25% water and 70% ethanol (or isopropanol but preferably ethanol). Do not put more than 1 species in a vial; this may entail some tedious sorting in the field since duckweeds usually grow in mixed communities. The preserving fluid may need to be replaced after several weeks since it extracts chlorophyll and pigments from the plants and becomes quite dark and opaque.

LEGENDS FOR GROUP 'A' FIGURES

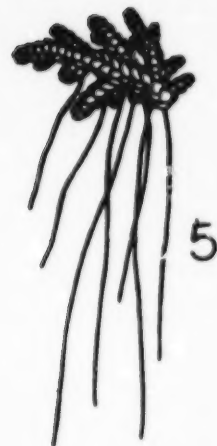
- 1 - Lemna gibba
- 2 - Lemna minor
- 3 - Lemna trisulca
- 4 - Spirodela polyrhiza

- 5 - Azolla filiculoides
- 6 - Salvinia rotundifolia
- 7 - Ricciocarpus natans
- 8 - Riccia fluitans

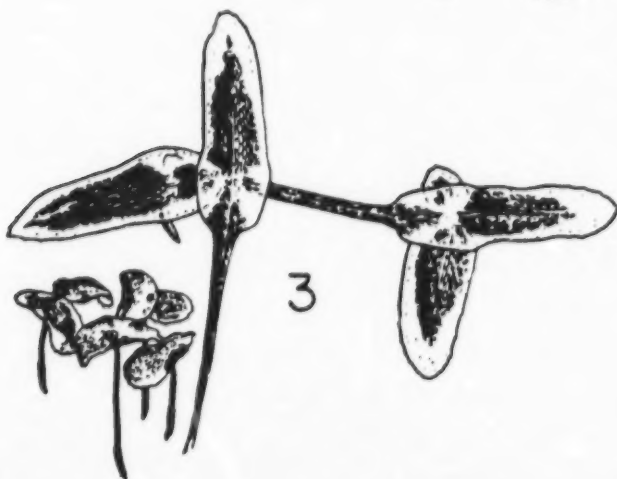
GROUP A



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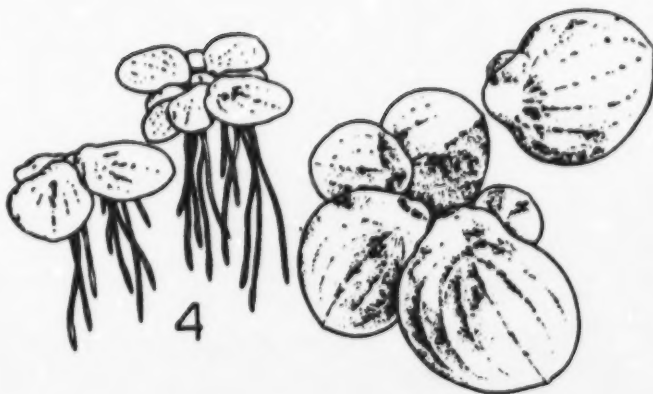
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GROUP 'B'

These are the stiff or erect species which do not clump together or collapse when removed from the water. Most are marginal and emergent species that can support themselves out of water. Almost all are rooted in the bottom and have leafy stems which emerge into the air. A few species may be small enough to fit into a 20 ml vial but most are much bigger. A number are totally submerged but rigid and self-supporting. Most of these do not have leafy stems but rather roots and leaves arise directly from a swollen base. Submerged species which are erect and self-supporting include: Isoetes spp., Lobelia dortmanna, Subularia aquatica, Lilaeopsis occidentalis, Tillaea aquatica, and sometimes Veronica spp.

The emergent species which are self-supporting include: Sparganium emersum, Sparganium eurycarpum, Ranunculus flammula, Alisma spp., Sagittaria spp., Equisetum spp., Lilaea scilloides, Scheuchzeria palustris, Menyanthes trifoliata, Calla palustris, Acorus calamus, Cicuta spp., Berula erecta, Oenanthe sarmentosa, Sium suave, Veronica spp., Mimulus spp., Iris pseudacorus, Typha latifolia, Hypericum spp., Lysimachia spp., Myrica gale, Potentilla palustris, Myosotis spp., Triglochin spp., Gratiola spp., Montia fontana, Dulichium arundinaceum, Rhynchospora alba, Eleocharis palustris, Scirpus lacustris, Elatine spp., and Marsilea vestita.

DESCRIPTION OF THE GROUP 'B' PLANTS

Veronica spp. are marginal plants generally submerged in the spring and emergent in summer. They are small and inconspicuous, and being more common in wetland habitats are not often collected around lakes. Tillaea aquatica is very small and usually overlooked. It generally grows on bare mud flats as water levels recede in the summer or in wetlands and vernal pools. Lilaeopsis occidentalis is a small submerged plant with hollow segmented leaves like small sausages. It grows in marshes, salt flats and sandy or muddy beaches. It is generally in coastal or tidally influenced areas (such

as Pitt Lake) and may be exposed at low water levels. It is rarely collected. Subularia aquatica is a small plant generally submerged along the margins of lakes and ponds. It is an inconspicuous plant (probably more common than collecting records indicate) usually overlooked by collectors. Lobelia dortmanna has thick fleshy leaves in a basal rosette. The plant usually grows in shallow water on hard sandy bottoms where it can send its inflorescence up to the surface. Deep water plants do not flower. The white flowers are very showy and conspicuous when large mats of Lobelia are found. The roots are also a very striking white and occur in a dense clump. Ranunculus flammula is usually found creeping among the rocks or on the wet grassy margins of lakes and is conspicuous with its bright yellow "buttercup" flowers. It may also be found in shallow marginal habitats. The leaves may be strictly linear or may have spatulate ends. Elatine spp. are small mat forming plants growing on mud flats or in shallow water at the margins of ponds. They are inconspicuous and rarely collected in lake surveys. Alisma gramineum has long, narrow, spatulate leaves about as long as the mature inflorescence. Alisma plantago-aquatica has short broad leaves and a very tall inflorescence. Both usually grow in shallow water with the leaves and certainly the inflorescences emergent. They are marginal plants in lakes or found in ponds and vernal wet areas. Pressing the mature inflorescence from an A. plantago-aquatica plant is a challenge; look for small plants or less mature specimens. Sagittaria spp. are difficult to distinguish. Leaves are of little diagnostic value; intact inflorescences with flowers and fruits are required. Do not lose the white petals which usually fall off in the collecting bag. These are also usually marginal and shallow water plants but both Alisma and Sagittaria may grow in deep water with non-surfacing linear leaves totally unlike their typical emergent leaves. Equisetum spp., the horse-tails, are usually marginal in lakes or found in shallow ponds and wet seepage areas. The stems are segmented and hollow and may not have any branches. The fruiting structure - a 'cone', is apical. The 'cones', presence or absence of branches and details of the bracts at the joints are all diagnostic. In addition some species have separate fruiting and vegetative stems which are morphologically distinct. Lilaea scilloides is an inconspicuous plant of

shallow water or mud banks left by dropping water levels. It is found from coastal tideflats to interior valleys but rarely collected. Scheuchzeria and Lilaea have unique and diagnostic inflorescences and may not be recognized when sterile. Isoetes spp. are not practically distinguishable without microscopic examination of the spores found in a pouch at the base of the quill-like leaves. These fully submerged plants may grow in quite deep water. Myosotis spp. and Mimulus spp. are marginal or floating-mat species, usually in ditches, ponds, and other protected water. They sprawl or creep over the mud, hang down from banks, or root in shallow, seasonally-flooded bars and banks. Both have showy flowers, yellow in Mimulus and blue in Myosotis. They also inhabit small creek beds, especially in the mountains. Triglochin spp. are found in wet, marshy areas in shallow water or in seasonally or tidally inundated areas. All tolerate brackish, saline or alkaline water and grow in coastal bogs, inland meadows and mud flats and in estuaries or coastal strands. A mature inflorescence with fruits is generally required for species identification. Gratiola spp. are small and inconspicuous and rarely collected. They grow in shallow water and on muddy shores or other wet places. Montia fontana is another small inconspicuous plant of shallow vernal ponds and exposed mud banks or wet meadows. Dulichium arundinaceum is a marginal and shallow-water plant which is in the sedge family but looks quite grass-like. It may also grow in marshes and wet meadows. It is a unique monotypic genus and once recognized should not be confused with anything else. Sium sauve is a variable plant related to the Cicuta/Berula/Oenanthe group. All are marginals in lakes and found in other wet meadows and marshes. The main diagnostic feature within this group of genera is the relationship of leaf-vein endings to leaf-margin teeth. Sium in particular also grows submerged where it takes on a very distinct, narrow-leaf form and does not at all resemble the emergent plant. Hypericum anagalloides often grows on logs floating on the water and trails down into the water. It also grows on wet, mossy banks subject to seasonal flooding. The other species tend to be on gravel bars, stream deltas on lakes and seasonally inundated gravel shores. They have yellow flowers. Lysimachia thysiflora grows as an emergent or marginal in quiet ponds and on sheltered lakeshores or in ditches. Potentilla palustris is a sprawling shrub along

the margins of lakes and ponds and often growing in quite deep water in beaver dammed pools. The flowers are a deep wine-red colour which is unusual in the genus. Menyanthes trifoliata (buckbean) forms extensive beds along the shallow water margins of lakes. The 3-lobed leaves and striking white flowers make this plant easily recognizable. Calla palustris is a northern species growing along the shallow margins of lakes and in wet places. The inflorescence looks like a white skunk cabbage (to which it is related) and has bright red fruits in the fall. The plant is poisonous. Eleocharis palustris is an emergent or marginal plant in the sedge family. The species is very variable and widespread in the northern hemisphere. It may be a large plant, up to a meter tall, and grows from a tough rhizome. Eleocharis acicularis is a very small mat-forming species often inhabiting muddy banks left dry by declining water levels. Typha latifolia usually grows in quite shallow marginal areas or in wet seepage spots and ditches. The plant is very common throughout B.C. and produces vast quantities of pollen and seeds. Only the one species is known at present though others grow in nearby areas. The diagnostic character for T. latifolia is the lack of a gap between the male and female flowers on the spike. Similar species growing in surrounding areas have such a gap. The 'cat-tail' may reach 3 m in height. Acorus calamus is a smaller plant than the 'cat-tail' but with the same general growth habit. It is however, related to Calla and 'skunk-cabbage'. It is known from Montana, Washington and Idaho but very rare in B.C. and grows in shallow marginal habitats as an emergent. Sparganium emersum and S. eurycarpum are found in marshes and shallow marginal areas. Both are robust, bright green, conspicuous, emergents. S. eurycarpum may reach more than 2 m in height while S. emersum is only about half as tall. The large spiny, globular, fruits are very characteristic with the shape of the seed, as shown in the figures, serving to distinguish them. The seeds of S. emersum taper gradually to a point while those of S. eurycarpum are abruptly truncate. Also S. emersum inflorescences are unbranched while those of S. eurycarpum branch several times. Iris pseudacorus is an emergent, introduced but quite widespread around B.C. It is a large robust plant up to 2 m tall and grows in dense clumps. The flowers are yellow and the seed capsules up to 10 cm long. This plant should not be confused with anything else. Scirpus lacustris, the bulrush, is a very widespread

marginal species in B.C. often forming a complete impenetrable fringe around lakes, ponds and marshes. It often grows in shallow water well out into exposed portions of lakes where its extensive rhizome system stabilizes the sandy bottom. Carex spp. are numerous and widespread throughout B.C. Most grow in wet, seepage habitats though some inhabit dry sand-dunes and some are marginal aquatics. Mature fruits are required for positive identification in this taxonomically difficult group. C. sitchensis, found mostly on the coast and C. aquatilis found in the interior represent the many species of Carex in the accompanying figures. Juncus spp. are mostly marginal though some grow in shallow water and may be seasonally inundated. A mature inflorescence is usually needed to identify a rush. J. nodosus represents the many Juncus species found in B.C. in the figures. There are a number of genera of grasses which grow in wet marginal habitats in B.C. In most cases leaf-sheaths and mature fruits are required for identification and it is usually best to collect some of the roots or rhizomes as well. One genus, which tends to grow in deeper water and not be an erect emergent like the rest, Glyceria, is treated under group C. Wild rice, Zizania aquatica, is the grass species illustrated.

COLLECTION METHODS

Unless otherwise indicated below, the whole plant should be collected - roots, stems, leaves, flowers and fruits. During the day while you are still collecting keep these plants in large plastic bags, big enough to enclose the whole plant. On an overcast or rainy day there will be no problem but on a hot sunny day the plants will wilt fairly quickly and make poor specimens. If the plant was collected underwater keep some water in the bag, or even collect into a bucket of water; but if the plant was emergent do not submerge it, just keep the humidity in the bag quite high and do not allow the top of the plant to project out of the bag and wilt. If you are returning from the field within a day you may bring the plants back in the bags and press them in the laboratory, at home or in the motel. If necessary they will keep well in the crisper portion of the refrigerator overnight. Don't keep them too long or the quality of the specimens deteriorates. Plants should be pressed as quickly as possible after collecting.

Under some conditions it may be necessary to bring back frozen specimens from the field. Group 'B' plants do not survive freezing as well as the group 'C' plants and the resulting samples may not be suitable for permanent herbarium specimens. However, the plants are identifiable and provide distribution records. If frozen plants are being brought back put each specimen in its own separate small plastic bag. Put all the separate bags from one lake or site in a larger plastic bag with a common label. This is also a good technique when bringing back fresh material in plastic bags. It keeps small specimens from getting lost and some species like Utricularia from becoming entangled. A large mass of tangled, previously frozen plants is difficult to separate without damage.

Plants should be mounted on special water-resistant herbarium mounting board which is precut to the correct size. Keep the bottom right hand corner free; this is where the label will eventually be glued. Labels are five inches wide and three inches high. In this space write, lightly in pencil, the date, the name of the site (lake, reach, sample), and the collectors name. You may also enter any other ecological data you wish. This information will be transferred to a label which is then glued in this corner.

Keep all notes with the plants, not on scraps of paper. Lay the plant on the mounting board, roots in the bottom left corner, and fold over the top of the plant if it is too tall. Put the plant and mounting board between clean newsprint and then the whole package between two pieces of corrugated cardboard. When you have finished put the whole pile of material between the end boards of a plant press and cinch up the 2 straps lightly. Next have someone stand on the press while you tighten the straps as much as possible. The plants must be pressed tightly to prevent them from shrivelling while drying. Retighten the straps daily for the first few days as the plants dry and flatten. Arrange all the mounting boards the same way and have all newspaper wrappers open to the same side (preferably to the right); this greatly facilitates the job of taking the press apart. The press must be dried fairly quickly or else the plants will rot and fungi

will begin to grow,. Herbaria have forced-hot-air drying cabinets for this purpose. In the field place the press on the roof of the truck for several days to force warm air past the plants. Remember to stop and bring the plants in if it rains. Motels have hot air registers, ducts or radiators which can be used. Hairdryers also make good forced-hot-air sources. When drying, blow the hot air through the corrugations in the cardboard, which should all be facing the same direction, in order to get warm air right inside the press and as close to the plants as possible. Laboratory ovens should be set at 40°C for several days.

SPECIFIC DETAILS FOR GROUP 'B' PLANTS

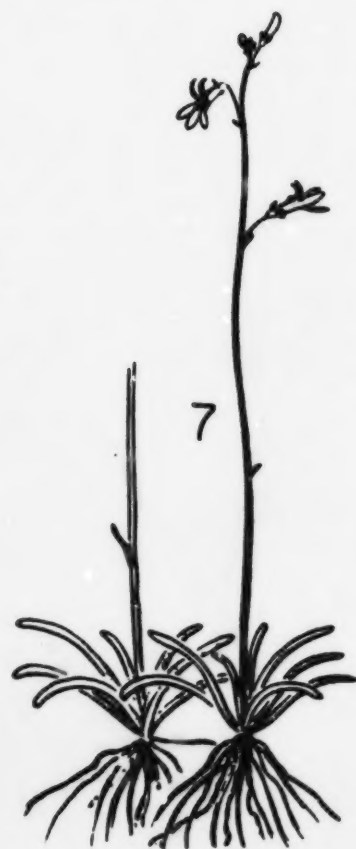
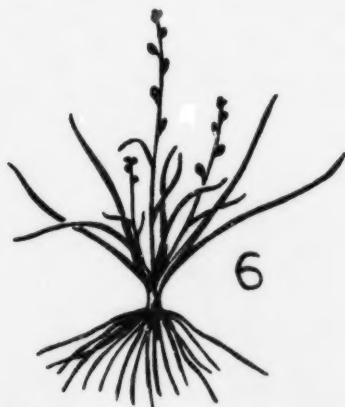
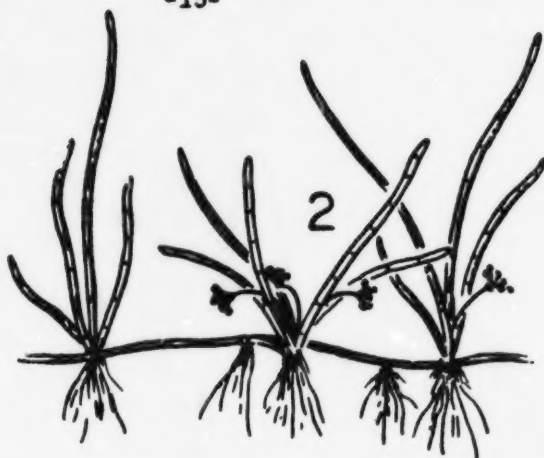
The species in the following list need no special handling - simply press the whole plant as you find it. All plants should be rinsed free of dirt and adhering wood chips and gravel in the roots. Veronica spp., Tillaea aquatica, Lilaeopsis occidentalis, Subularia aquatica, Lobelia dortmanna, Ranunculus flammula, Alisma spp., Sagittaria spp., Equisetum spp., 'grasses', Lilaea scilloides, Scheuchzeria palustris, Myosotis spp., Triglochin spp., Gratiola spp., Montia fontana, Dulichium arundinaceum, Eleocharis acicularis, Elatine spp., Sium suave, Mimulus spp., Hypericum spp., and Lysimachia thyrsiflora. Carex spp. and Juncus spp. may have extensive rhizomes. Collect a short piece of this rhizome with each emergent plant. Menyanthes trifoliata, Calla palustris and Potentilla palustris all have extensive creeping woody rootstocks. Take a short section of rootstock with one cluster of leaves and flowers. Eleocharis palustris grows in clumps from a rhizome. Break off a small section of rhizome with several emergent stems attached, preferably fruiting stems. Isoetes spp. grow from a swollen two-or-three-lobed base which may be hard to press. With large specimens slice this base into two or three sections vertically and press all the slices; small specimens may not require slicing and can be pressed whole. Sparganium emersum and S. eurycarpum plants can be pressed whole, although the latter may sometimes grow rather large. It is the large, hard, globular, spiny fruits which are a problem and longitudinal slicing may be required. Acorus calamus and Typha latifolia

are both very large 'cat-tails'. With a sharp knife cut a short section of stem with several leaves. If you can find a small plant, take the whole thing along with a piece of rhizome. Young inflorescences can be pressed whole but large mature ones are a problem. They are diagnostic and required to differentiate one species from another. Slice them longitudinally into three portions and keep the central portion with the stem; the other two outside pieces will fall apart. Iris pseudacorus is a large yellow flowered marginal plant. A short piece of stem with leaves and the flowers are sufficient. The fruits are quite large and bulky and may not press well unless sliced open. A common technique for fruiting plants where the seeds may be shed on drying is to collect the seeds, which are often diagnostic, in small paper or cellophane pouches and attach these pouches to the finished herbarium sheet. Scirpus lacustris, the large (up to 3 m) bulrush, is also a problem. All that is really necessary is the upper portion of the stem with the inflorescence, though again if a small plant can be found at the apex of the rhizome it could also be collected intact. Cicuta spp., Berula erecta and Oenanthe sarmentosa are all closely related plants and very similar. The patterns of the veins on the leaves are diagnostic as is the structure of the swollen base of the plant. Slice the swollen base longitudinally so as to expose the internal cross-septa and press the pieces cut side up so the internal structure can be seen. Cicuta has several large chambers in the tuberous base. (Cicuta douglasii is very poisonous; a cow may die from eating one tuber. Be careful).

LEGENDS FOR GROUP 'B' FIGURES

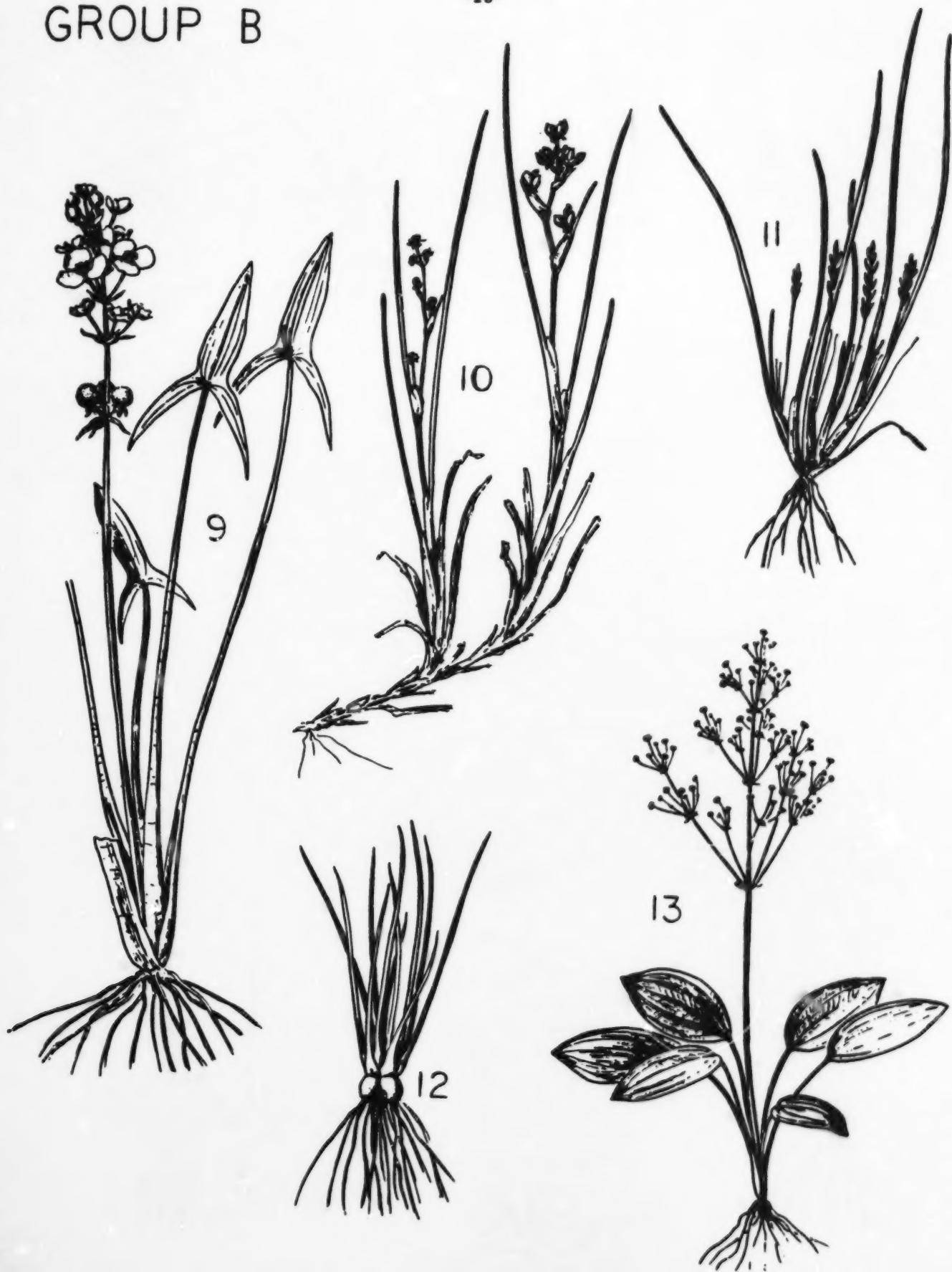
- | | |
|--------------------------------------|------------------------------------|
| 1 - <u>Veronica americana</u> | 22 - <u>Berula erecta</u> |
| 2 - <u>Lilaeopsis occidentalis</u> | 23 - <u>Cicuta douglasii</u> |
| 3 - <u>Tillaea aquatica</u> | 24 - <u>Dulichium arundinaceum</u> |
| 4 - <u>Ranunculus flammula</u> | 25 - <u>Cicuta bulbifera</u> |
| 5 - <u>Alisma gramineum</u> | 26 - <u>Acorus calamus</u> |
| 6 - <u>Subularia aquatica</u> | 27 - <u>Lysimachia thyrsiflora</u> |
| 7 - <u>Lobelia dortmanna</u> | 28 - <u>Calla palustris</u> |
| 8 - <u>Elatine triandra</u> | 29 - <u>Menyanthes trifoliata</u> |
| 9 - <u>Sagittaria cuneata</u> | 30 - <u>Hypericum anagalloides</u> |
| 10 - <u>Scheuchzeria palustris</u> | 31 - <u>Eleocharis palustris</u> |
| 11 - <u>Lilaea scilloides</u> | 32 - <u>Sparganium emersum</u> |
| 12 - <u>Isoetes lacustris</u> | 33 - <u>Eleocharis acicularis</u> |
| 13 - <u>Alisma plantago-aquatica</u> | 34 - <u>Sparganium eurycarpum</u> |
| 14 - <u>Equisetum fluviatile</u> | 35 - <u>Typha latifolia</u> |
| 15 - <u>Mimulus tilingii</u> | 36 - <u>Juncus nodosus</u> |
| 16 - <u>Montia fontana</u> | 37 - <u>Iris pseudacorus</u> |
| 17 - <u>Myosotis scorpioides</u> | 38 - <u>Potentilla palustris</u> |
| 18 - <u>Gratiola neglecta</u> | 39 - <u>Scirpus lacustris</u> |
| 19 - <u>Triglochin concinnum</u> | 40 - <u>Carex sitchensis</u> |
| 20 - <u>Oenanthe sarmentosa</u> | 41 - <u>Carex aquatilis</u> |
| 21 - <u>Sium sauve</u> | 42 - <u>Zizania aquatica</u> |

GROUP B



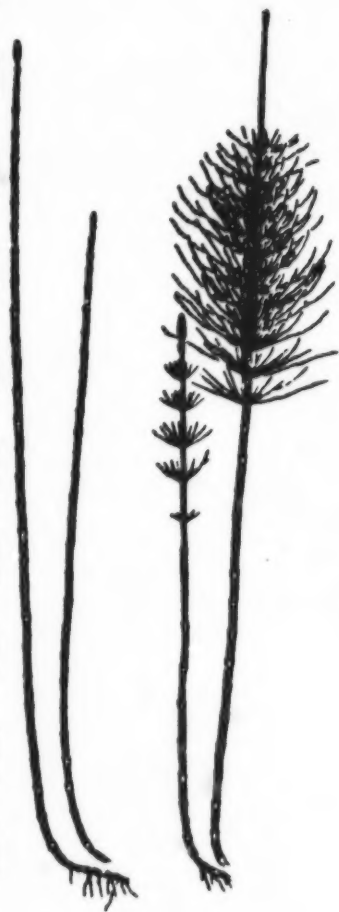
GROUP B

-16-

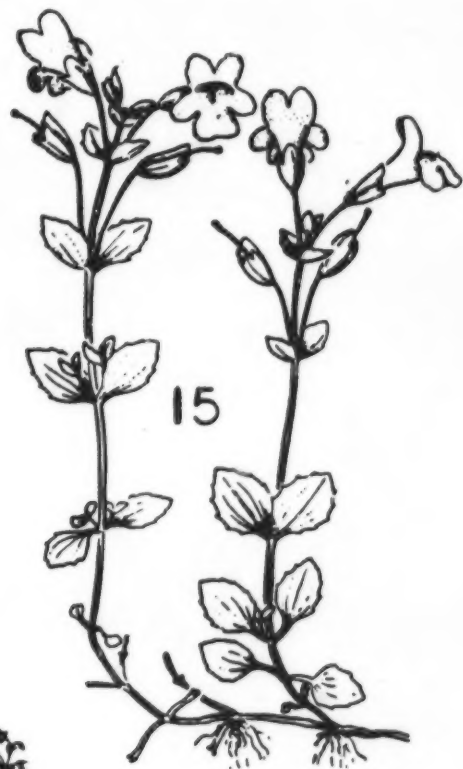


GROUP B

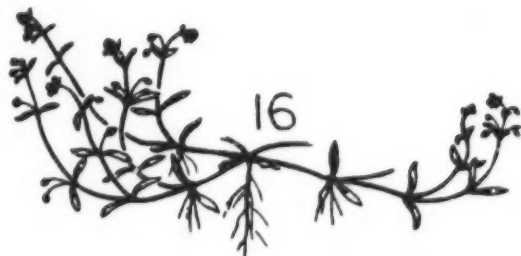
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GROUP B





25



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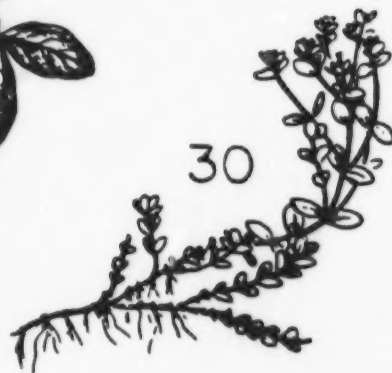
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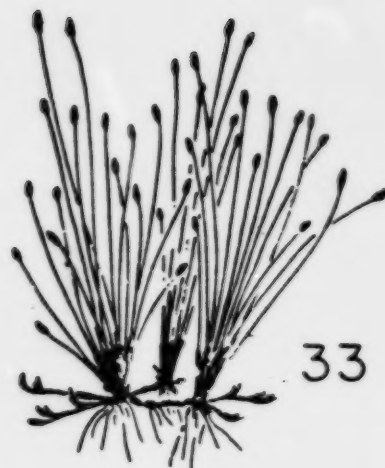
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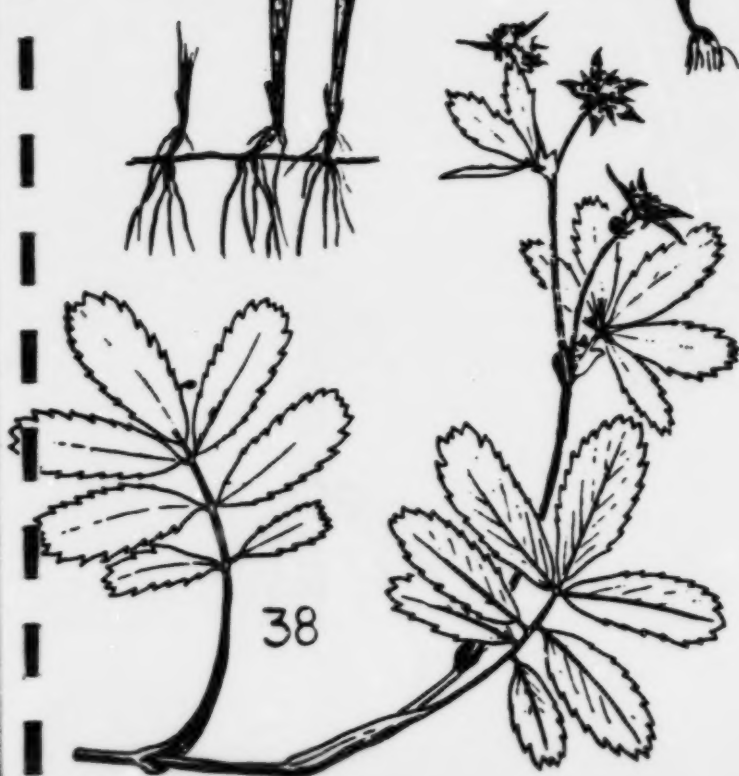
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GROUP B

-20-



GROUP B



GROUP B

-22-



GROUP 'C'

These plants usually grow underwater or else floating on the surface with only their flowers emergent. Some are rooted in the bottom while others are free-floating. Some species may at times be sufficiently stiff to be pressed like group B plants but they generally need to be mounted in a different manner. Submerged specimens of Sium sauve and grasses in the genus Glyceria fall into this group. Occasionally some species in this group may become so encrusted in 'marl', when growing in hard water, that they are rigid enough to be treated like group B plants, except that they should have a blotter added to the press as indicated below. Ceratophyllum demersum and Myriophyllum exalbescens fall into this group.

Terrestrial plants of Hippuris vulgaris, Ranunculus spp., Myriophyllum spp., Polygonum spp., and Potamogeton spp. are sometimes found. They are dry and firm enough to press like group B plants. Elodea may also grow in a dense, short-internode form which is quite firm and self-supporting. Apart from the above exceptions this group is treated together because they tend to collapse or clump together when removed from the water. For this reason they need to be floated onto the mounting sheet. As a rule the whole plant should be collected (roots, stems, leaves, flowers and fruits); though as indicated later there are exceptions to this rule. Once mounted and dried many Group 'C' plants adhere to the mounting board and cannot be removed without damage, thus they must be mounted directly onto their permanent mounting board and may not be dried first between newsprint and then transferred to the board. This latter technique is used with terrestrial plants and may be used on some emergent group 'B' plants.

DESCRIPTIONS OF THE GROUP 'C' PLANTS

Nuphar spp. are the native yellow waterlily or cow lily. They grow from subterranean rhizomes which may be many meters long and 20 cm in diameter. Only the petioles grow to the surface with a large floating leaf which may often be too large to press whole. The leaf is green on top and bottom and may be emergent when water levels drop. The plants will also grow on wet mud when stranded by declining water levels. Both species have large robust yellow flowers and a sticky mucilaginous coating around the seeds. They grow in marginal situations and in water to 2-3 meters deep. Brasenia schreberi has peltate leaves reddish-green above and red below. The flowers are small, inconspicuous and reddish. The entire submerged portion of the plant is covered in a slippery mucilaginous layer which makes collecting difficult. Brasenia is also a marginal species growing from rhizomes and may grow a little deeper than Nuphar. Nymphaea spp. are ornamental water lilies with red, white, pink, yellow or multicoloured flowers. There are a number of "escaped" populations in B.C. but most are cultivated by lakeshore owners. Be discrete and tactful when collecting Nymphaea. They grow from large subterranean rhizomes and only petioles ascend to the surface as in Nuphar. The floating leaves may be red on the lower surface and are usually smaller and rounder than Nuphar leaves. Fontinalis antipyretica is an aquatic moss often found attached to rocks or logs around the margins of lakes and in streams. It may grow quite deep or in habitats left exposed in summer low water conditions. In the latter case it becomes dormant for the summer. This plant has not been found in B.C. waters with a pH higher than 8.1 since it can not utilize HCO_3 as an inorganic carbon source for photosynthesis but relies on dissolved CO_2 . All the Ranunculus species are shallow water or marginal plants most often found in ponds and ditches, wet meadows or wet muddy areas left by receding water levels. R. aquatilis is the most aquatic and may grow as floating mats in deeper water. All are semi-terrestrial and may be found growing on land in modified form. The proper taxonomic status of some of these 'species' is not clear as many are quite similar and all are morphologically plastic in these vegetative characteristics. They have yellow 'buttercup'

flowers except for R. aquatilis which is white. Rorippa nasturtium-aquaticum, watercress, is a plant of wet seepage areas, shallow ditches and marginal habitats. It grows in dense mats sprawling over the water and on the banks or shores and prefers nutrient rich water. Ceratophyllum spp. do not have roots but may be anchored on the bottom. Usually they float free in large dense mats at the surface. In eutrophic waters C. demersum can become a nuisance. C. echinatum generally grows well submerged and is more difficult to find and collect. They are superficially very similar and may be distinguished by the spines on their fruits which are hidden amongst the foliage near the surface. Try to collect some of these fruits in late summer. Chara spp. and Nitella spp. are large algae growing in clumps or mats completely submerged in lakes and creeks, some in quite deep water. Chara has a strong, unpleasant odour when brought out of the water. When fruiting many small orange or red structures may be seen among the branches. The species are difficult to distinguish and generally require a dissecting microscope. Hippuris vulgaris grows on exposed mud banks or in very shallow water where it has short, firm, bright green whorls of leaves or in deep water where the leaves are long, limp and brownish. If it reaches the surface in deep water the leaf form changes abruptly at the water's surface and both types are found on the same plant. The stem is hollow and appears jointed. Elodea spp. are widespread in a variety of habitats and may become weeds in eutrophic conditions. They may be quite open with long gaps between leaves or very compact. Since these are favoured aquarium plants, they may be introduced to a number of lakes. Flowers are very small, white, and on the ends of very long thin stipes so as to reach the surface; they are rarely found or collected. The plants may be found floating freely in a mat at the surface. Polygonum spp., 'smartweeds', are usually marginal or marsh plants but P. amphibium may also grow either in very deep water with a clump of leaves at the surface and anchored to the bottom by roots and a long stem or as a low mat on exposed shores. They have clumps of rose coloured flowers. Only P. amphibium has broad floating leaves, the others are more emergent species with inconspicuous flowers. Limosella spp. are small rooted plants in shallow water or wet mud. They are inconspicuous and

seldom collected. L. aquatica is widespread; L. subulata maritime. Najas flexilis is a fairly common small plant which is inconspicuous when rooted on the bottom and usually collected from floating fragments. It has very distinctive, smooth, lenticular seeds and grows completely submerged in shallow to deep water. Vallisneria americana is a common aquarium plant and has been introduced to many lakes in B.C. When immature and vegetative it is easily mistaken for several other species but in flower or fruit with its long, coiled, peduncle it is a unique and unmistakable plant. It grows in quiet water, preferably warm, and can be found to moderate depths. It is completely submerged and not found as a marginal. Juncus supniformis is found both marginally with other Juncus spp. and out into deep water as a floating mat but anchored to the bottom. The plant is proliferous, producing 'runners' (like a strawberry), which in turn produce more 'runners' as they mature. By the end of the summer a large floating, tangled mat of plants can be produced from a single parent plant in deep water. Zannichellia palustris is a very small creeping plant fully submerged in shallow water. It is usually overlooked since it creeps along the bottom amongst the other vegetation but is instantly identifiable in fruit and likely a lot more common than collecting records indicate. Heteranthera dubia is submerged or floating just at the surface in lakes, streams and ponds in quiet water. The flowers are pale yellow but rarely seen in B.C.; the plant can be difficult to identify without them. This plant is rarely recognized and collected but likely restricted to southeastern B.C. Marsilea vestita is very rare and known only from several Okanagan locations. It looks like a hairy 4-leaf clover but is actually an aquatic fern with small, hairy, brown sporocarps at the bases of the leaves. It is usually found on wet mud or gravel left exposed in summer by dropping water levels, but also grows in shallow-water marshes. Callitriche spp. may be found in 1 or 2 meters of water in slow creeks or lakes but most often in marginal habitats, in ditches or stranded on wet mud. In deep water, plants are usually rooted in the bottom, have a thin leafy stem in the water column and a rosette of dark green leaves in a cluster at the surface. In ditches they may form very extensive mats covering the entire surface. Diagnostic characters include the details of leaf-apices, leaf-venation, the junction

of leaf and stem and most importantly the morphology of mature fruits.. C. verna, one of our five species, represents the genus in the illustrations. Ludwigia palustris is a marginal or marsh plant found only in shallow water and often sprawling out over the surface while rooted at or just below water level. This species often has reddish leaves and is another favourite aquarium plant. Bidens beckii seems to prefer nutrient rich sites. In flower, with its yellow, emergent, head and finely-dissected submerged leaves, it is unmistakable. Sterile specimens must be distinguished from other dissected-leaf genera such as Ranunculus spp., Myriophyllum spp., Ceratophyllum spp. and Utricularia spp. by the pattern of the leaf dissections. Details of this dissection pattern are shown in Group 'C' illustrations as an identification guide. Bidens is not usually marginal but grows in about 1-2 meters in quiet, 'weedy' warm-water areas. Utricularia spp. are very widespread throughout B.C. and very distinctive both vegetatively with their bladders which trap planktonic organisms, and in flower with their yellow 'snap-dragon like' blossoms. U. intermedia, which is illustrated, is often found in acid sphagnum bogs. One branch with bladders is white and anchored in the substrate, other leafy branches are on top of the substrate. This species usually occurs in shallow marginal habitats. U. vulgaris has bladders and leaves together on one large, much-dissected branch. The stem may be 20 cm. in diameter and up to 6 m long. It usually lies on the bottom but in shallow, warm, 'weedy' ponds may be just below the surface. Scirpus subterminalis grows in shallow marginal habitats in quiet water. The leaves are very thin and lax and float on the surface although the fertile stems may be emergent. The plants are rhizomatous and rooted in the bottom and often grow in quite extensive beds. Glyceria spp. are grasses often found in wet meadows, marshes and shallow marginal areas. The leaves float on the surface of the water and are quite flaccid. Ruppia maritima grows generally in shallow or marshy areas but may be rooted up to 1 meter deep. It is very tolerant of saline or alkaline conditions and may be found in coastal estuarine sites or interior highly alkaline ponds. It is a favorite food of ducks. The plant is scarcely distinguishable from some linear-leaved Potamogeton spp. except when it has

a cluster of distinctive fruits on a coiled peduncle. Sparganium fluctuans and S. minimum are both usually shallow-water marginal or marsh species with emergent fruiting spikes but lax floating leaves.

Both are much more delicate plants than the two group B Sparganium spp. and S. minimum has only one male head and two or three female heads in an unbranched inflorescence; S. fluctuans has a branched inflorescence with two male heads and two or three female heads on each branch. Myriophyllum spp. all have finely dissected 'feather-like' leaves in whorls around the stem. They may grow on mud banks exposed by receding water levels or as deep as 6 meters. Most have flowers on emergent spikes but some have flowers in the axils of ordinary submerged leaves. The genus occurs in a wide variety of habitats throughout B.C. although some species have very restricted distributions and specific habitat preferences. M. spicatum is illustrated as a typical species. Specific identification is difficult with vegetative material in most cases. Potamogeton is the largest genus of aquatic plants in B.C. and has a lot of variability. Potamogetons are found in almost all aquatic habitats from marshes, stranded on wet mud to 6 meters of water. One group which can be difficult to distinguish vegetatively has long, narrow, fully submerged leaves and no floating leaves. They are listed under the section on how to press group C plants. P. pectinatus is illustrated as an example of this group. Many of the remaining species of Potamogeton are illustrated to show the variety of forms that may be encountered. P. gramineus, in particular is very morphologically plastic and its appearance is almost site specific depending upon the environmental parameters of the site. The floating leaves of P. natans are usually quite reddish. Mature fruiting plants will have lost all submerged leaves. P. robbinsii plants are dark green but usually appear brownish since they form mats on the bottom and get covered in periphyton and detritus. P. gramineus is commonly found as a dwarf rosette plant on damp mud left by receding water levels. P. epihydrus submerged leaves are very thin and delicate. P. amplifolius is a very robust plant with large folded leaves.

COLLECTION METHODS

The date, the site, the collector's name and any other pertinent data should be written lightly in pencil in the bottom right hand corner of the mounting sheet. Write this information while the sheet is still dry since you can not write on this paper once it is wet. This information will later be transferred to a 3" high and 5" wide label which is glued in this corner. Write on the mounting board, not on easily lost or mixed up scraps of paper. To make good specimens and avoid 'clumping' caused by surface tension the plants must be floated gently onto the mounting board then the excess water drained off slowly. It is most convenient to carry a tray about 20" x 14" for this purpose but lakeshores, ponds, and motel bathtubs and shower stalls can be used. Do not mount on the shores of any lake except the one in which you collected the plants or you risk spreading aquatic weeds from lake to lake. Place the labelled mounting board under water and arrange the plant on top, roots in the lower left corner. If the plant is too tall fold its top over to fit it on the sheet. Do not cover the label area. Gradually raise the mounting board out of the water starting with the lower left corner and arrange the leaves neatly just before they come out of the water. Generally do not try to rearrange leaves once the sheet is out of the water. Once the last corner of the sheet is removed from the water drain the excess water off one corner for a few seconds then lay the board down on one half of a piece of newsprint. Place a piece of white blotter over the plant then fold the other half of the newsprint over the blotter. Put this package between two pieces of corrugated cardboard in a press. These plants must be collected into a bucket or plastic bag of water. They must not be allowed to dry out. See the section on Group 'B' plants for further details on care of the press, treatment of specimens prior to pressing and bringing back frozen specimens.

SPECIFIC DETAILS FOR GROUP 'C' PLANTS

The following species need no special treatment, press the whole plant as collected after rinsing off any mud or debris and floating onto the mounting board: Sparganium minimum, S. fluctuans, Ranunculus spp., Utricularia intermedia, Callitriche spp., Elodea spp., Najas flexilis, Vallisneria americana, Hippuris vulgaris, Ceratophyllum spp., Bidens beckii, Rorippa nasturtium-aquaticum, Ludwigia palustris, Ruppia maritima, Marsilea vestita, Limosella spp., Scirpus subterminalis, Heteranthera dubia, Zannichellia palustris and Myriophyllum spp.. Fontinalis antipyretica and other aquatic mosses hold a great deal of water and should have an extra blotter beneath the mounting board. Juncus supiniformis may grow as a very extensive tangled mass in deep water. All that is necessary is to collect the upper portion of the plant preferably with flowers and fruits and enough to show the proliferous nature of the species. Chara spp. and Nitella spp. are large algae anchored to the bottom. They have a tendency to stick to the blotter and thus before the blotter is put down pieces of polyethylene bag, waxpaper, cellophane or similar material should be placed over the plants. This will peel off readily once the press is thoroughly dry. Polygonum species, particularly P. amphibium, also have a tendency to stick and can be dealt with in the same manner. P. amphibium growing in deep water may have a very long bare stem with all the leaves at the surface. Collect only the surface portion of the plant with a short section of stem and flowers if available. Nuphar and Nymphaea floral details are required for identification. In Nuphar cut a thin cross-section of the petiole a short distance below the leaf and press it or note whether it is round or compressed. Cut one leaf in half from apex to notch and press it with one half upside down. Remove the green sepals and yellow petals from a flower and press them, note how many there are of each in the label; also press a few stamens and note whether they are all yellow or have reddish or purplish markings. As the flower parts may be sticky they should be treated as was Chara above to avoid sticking to the blotter.

Collect Nymphaea leaves as for Nuphar and also a few each of the sepals, petals and stamens. Note the colours of these flower parts and the number of each; note also whether or not the flower is fragrant, the time of day and whether or not the flower was open. Do not try to collect the rhizomes. Brasenia schreberi is unique in that the leaves are peltate (the petiole is attached in the centre of the blade). It also grows from a bulky rhizome and all that need be collected is the apical portion of the stem with several leaves, the bud and preferably the small red flowers. All the underwater portions of Brasenia are covered in a coat of mucilaginous or gelatinous material of variable thickness. When this dries the plants are permanently glued to whatever they are in contact with while being pressed. You must use a sheet of smooth non-porous material such as polyethylene or saran wrap between the plant and the blotter when pressing this species. Turn several of the leaves over to show the undersides as this will not be possible later. Utricularia vulgaris may be small enough to press in its entirety but may grow to be 6 m long and 20 cm in diameter. In the latter case take only the apical portion of the plant. Try to find the yellow, emergent, 'snap-dragon-like' flowers later in the season in warm quiet ponds and bays. There are 26 species of Potamogeton in B.C. in a wide diversity of habitats and growth forms. Many are too big to fit on a herbarium sheet as they may surface from as deep as 5 m. Deep plants usually have few submerged leaves except near the apical portion of the stem. Many also have floating leaves arising near the stem tip and in the case of P. natans lose their submerged leaves at this time. Collect only the upper portion of the stem with flowers, fruits, floating leaves and a few submerged leaves. When pressing these plants make sure some leaves of each type are upside down and some right side up. Species in this group include P. diversifolius, P. natans, P. amplifolius, P. nodosus, P. illinoensis, P. gramineus, P. epihydrus, P. alpinus and P. oakesianus. P. robbinsii usually grows completely submerged as an appressed mat on the bottom but may be found with an erect, leafy, fruiting stem at times. Collect both the mat portion and the erect portion when possible. Potamogeton alpinus may have some floating leaves but if so they are not much different than the submerged leaves. The plant is small enough in any case to collect the whole thing including some of the rhizome. Potamogeton crispus, P. zosteriformis, P. praelongus and

P. richardsonii all have broad submerged leaves, but no floating leaves. Except for P. crispus at times, they are too large to press in their entirety and only the apical portion needs to be collected. Potamogeton vaginatus, P. filiformis, P. pectinatus, P. friesii, P. berchtoldii, P. fibrillosus, P. foliosus, P. obtusifolius and P. strictifolius have only submerged, linear leaves and all are usually small enough to collect the whole plant. If bigger specimens are found, take only the upper portions. Diagnostic characters in Potamogeton include the fruits, floating leaves, structure of the junction between leaves, stems and petioles, stipules and nodal morphology.

LEGENDS FOR THE FIGURES - (CON'T)

Group 'C'

- | | |
|--|---------------------------------------|
| 1 - <u>Nuphar variegatum</u> | 27 - <u>Bidens beckii</u> |
| 2 - <u>Fontinalis antipyretica</u> | 28 - <u>Ranunculus aquatilis</u> |
| 3 - <u>Brasenia schreberi</u> | 29 - <u>Utricularia vulgaris</u> |
| 4 - <u>Ranunculus aquatilis</u> | 30 - <u>Callitriche verna</u> |
| 5 - <u>Nymphaea tetragona</u> | 31 - <u>Marsilea vestita</u> |
| 6 - <u>Ceratophyllum demersum</u> | 32 - <u>Ludwigia palustris</u> |
| 7 - <u>Chara sp.</u> | 33 - <u>Utricularia intermedia</u> |
| 8 - <u>Polygonum amphibium</u> | 34 - <u>Ruppia maritima</u> |
| 9 - <u>Elodea canadensis</u> | 35 - <u>Bidens beckii</u> |
| 10 - <u>Limosella aquatica</u> | 36 - <u>Potamogeton pectinatus</u> |
| 11 - <u>Hippuris vulgaris</u> | 37 - <u>Scirpus subterminalis</u> |
| 12 - <u>Ranunculus cymbalaria</u> | 38 - <u>Sparganium minimum</u> |
| 13 - <u>Ranunculus hyperboreus</u> | 39 - <u>Myriophyllum spicatum</u> |
| 14 - <u>Ranunculus flabellaris</u> | 40 - <u>Potamogeton illinoensis</u> |
| 15 - <u>Ranunculus gmelinii</u> | 41 - <u>Potamogeton crispus</u> |
| 16 - <u>Ranunculus lobbii</u> | 42 - <u>Potamogeton natans</u> |
| 17 - <u>Rorippa nasturtium-aquaticum</u> | 43 - <u>Potamogeton robbinsii</u> |
| 18 - <u>Ranunculus sceleratus</u> | 44 - <u>Potamogeton richardsonii</u> |
| 19 - <u>Juncus supiniformis</u> | 45 - <u>Potamogeton amplifolius</u> |
| 20 - <u>Vallisneria americana</u> | 46 - <u>Potamogeton diversifolius</u> |
| 21 - <u>Polygonum hydropiper</u> | 47 - <u>Potamogeton alpinus</u> |
| 22 - <u>Najas flexilis</u> | 48 - <u>Potamogeton zosteriformis</u> |
| 23 - <u>Heteranthera dubia</u> | 49 - <u>Potamogeton nodosus</u> |
| 24 - <u>Zannichellia palustris</u> | 50 - <u>Potamogeton epihydrus</u> |
| 25/29 - Leaf dissection pattern details: | 51 - <u>Potamogeton gramineus</u> |
| 25 - <u>Ceratophyllum demersum</u> | 52 - <u>Potamogeton praelongus</u> |
| 26 - <u>Myriophyllum exalbens</u> | |

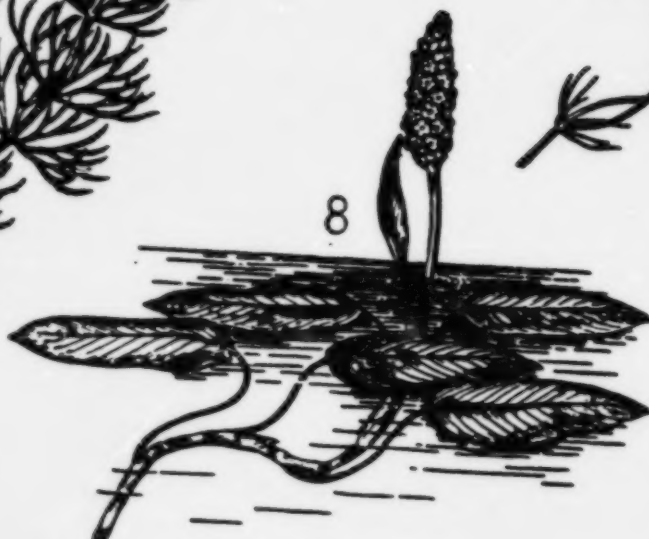
GROUP C

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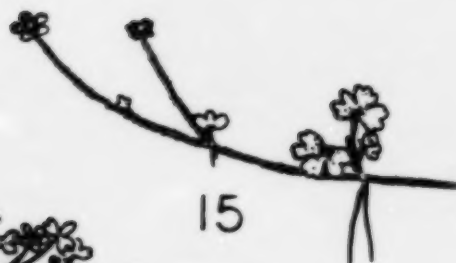
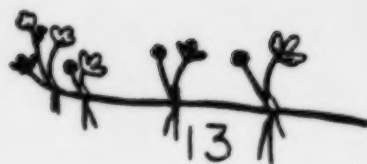


GROUP C

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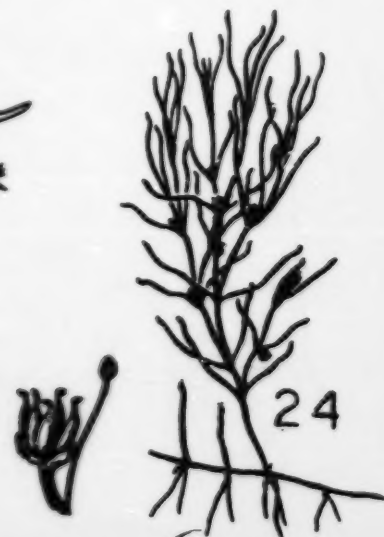
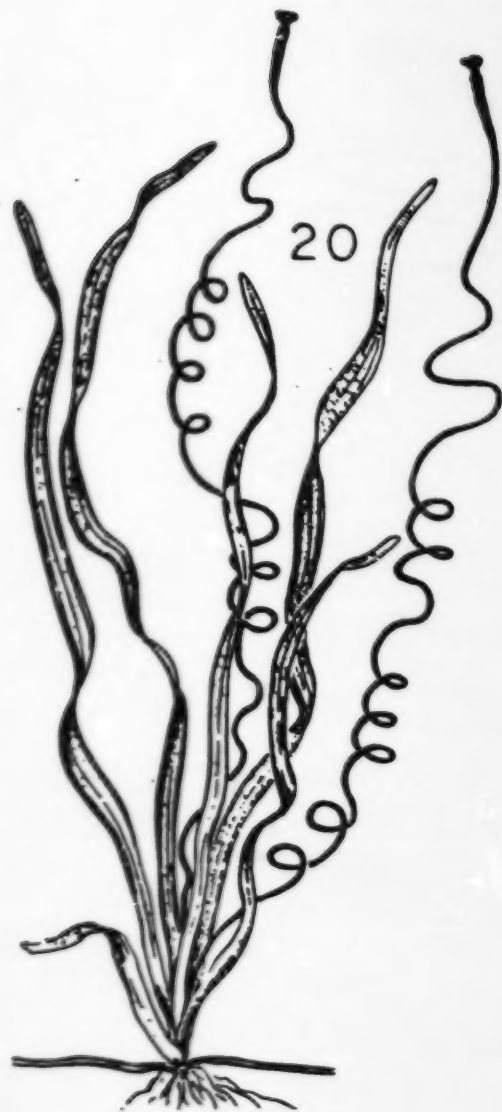


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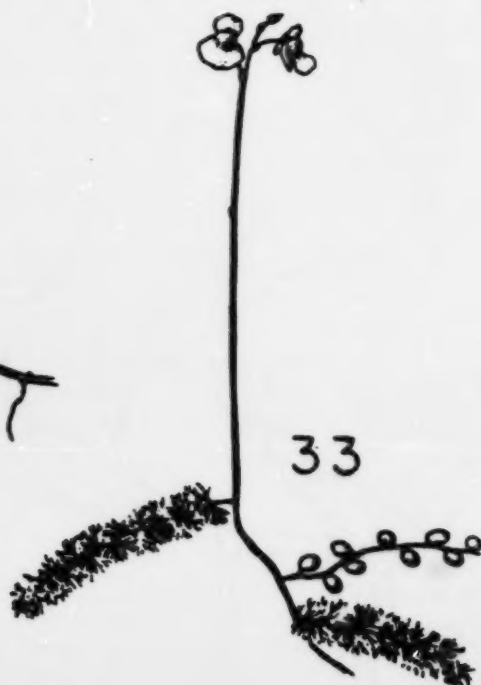
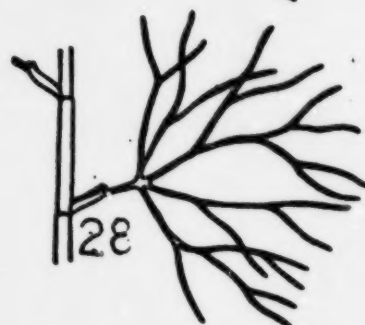
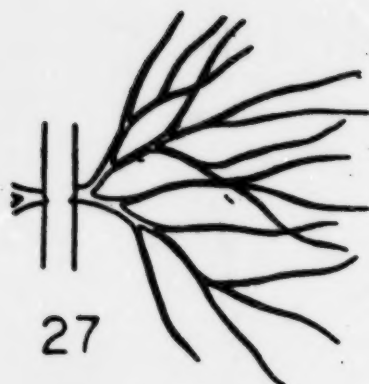
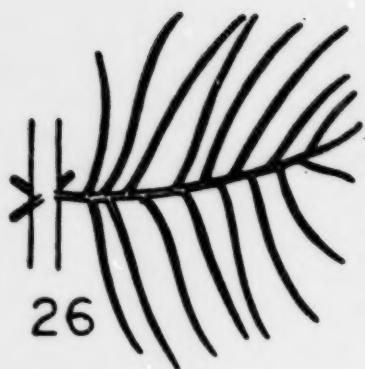


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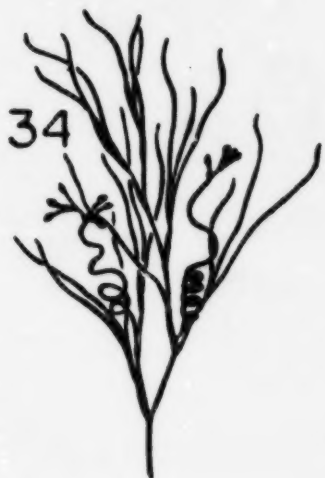
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GROUP C



GROUP C



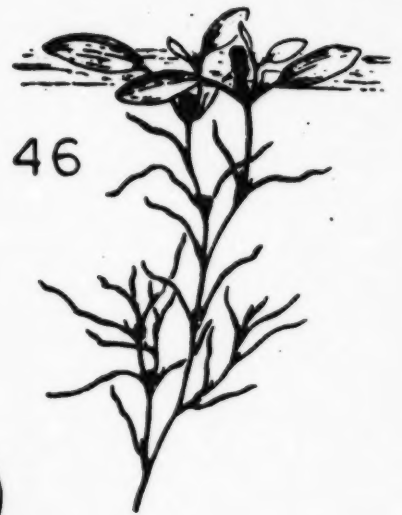
GROUP C

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GROUP C

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GROUP C

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